IEC 60079-11

Edition 6.0 2011-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"

Atmosphères explosives – Partie 11: Protection de l'équipement par sécurité intrinsèque «i»

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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EXPLOSIVE ATMOSPHERES –

Part 11: Equipment protection by intrinsic safety "i"

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee 31G: Equipment for explosive atmospheres – Equipment protection by intrinsic safety "i", of IEC technical committee 31.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
31G/235/ISH	31G/238/RVISH

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

Following decision No 16 of the TC 31 meeting in Melbourne in 2011, the issuing of an Interpretation Sheet for IEC 60079-11:2011 (6th edition) was requested, in order to clarify the significance of the changes with respect to the 5th edition.

Question

What are the minor editorial, extensions, and major technical changes of the 6th edition with respect to the 5th edition?

Answer

The following table shows the significance of the changes.

The significance of the changes between IEC Standard, IEC 60079-11, Edition 5, 2006-07 and IEC 60079-11, Edition 6, 2011-06 are as listed below

Significance of changes with respect to IEC 60079-11:2006

		Type		
Significant Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
General: Changes to remove specific clause references to other IEC 60079 standards	General	x		
Scope: Expansion to include Group III	1		x	
Scope: Table 1 updated to include references to both IEC 60079-0 Edition 5 and Edition 6	1		x	
Normative references: Deletion of IEC 60079-27, and addition of IEC 61158-2 and IEC 62013-1	2	x		
Terms and definitions: Commonly used definitions moved to IEC 60079-0. Energy limitation definitions moved from IEC 60079-0.New definitions added	3	x		
Spark ignition compliance: Group III ignition requirements added	5.5		x	
Temperature for small components for Group I and Group II: Relocated to IEC 60079-0	5.6.2	x		
Intrinsically safe apparatus and component temperature for Group III	5.6.5		x	
Enclosures for Group I or Group II apparatus	6.1.2	x		
Apparatus complying with Annex F	6.1.2.3 c)	x		
Enclosures for Group III apparatus	6.1.3		x	
Requirements for connections and accessories for IS apparatus when located in the non-hazardous area	6.2.5			C1
Separation of conductive parts	6.3.2	x		
Encapsulation	6.6.1	x		
Encapsulation used for the exclusion of explosive atmospheres	6.6.2			C2
Primary and secondary cells and batteries	7.4.1		x	
Battery construction	7.4.2		x	
Level of Protection “ic”	8.1	x		
Filter capacitors	8.6.2		x	
Wiring, printed circuit board tracks, and connections	8.8 c)	x		
FISCO apparatus	9.2		x	
Handlights and caplights	9.3		x	
Circuits with both inductance and capacitance	10.1.5.2	x		
Electrolyte leakage test for cells and batteries	10.5.2	x		
Spark ignition and surface temperature of cells and batteries	10.5.3	x		
Determination of the acceptability of fuses requiring encapsulation	10.6.2		x	
Optical isolators tests	10.11		x	
Marking	12.1	x		
Encapsulation	Annex D			C2
Fieldbus intrinsically safe concept (FISCO) – Apparatus requirements	Annex G		x	
Ignition testing of semiconductor limiting power supply circuits	Annex H		x	

Explanation of the Types of Significant Changes:

A) Definitions

1. Minor and editorial changes:

- Clarification
- Decrease of technical requirements
- Minor technical change
- Editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

2. Extension: Addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition.

3. Major technical changes:

- addition of technical requirements
- increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of 'Major technical changes'

C1 – Requirements for external connections, other than battery charging connections, that are designed for use only when an explosive gas or dust atmosphere is not present, for example when in a non-hazardous area or when a gas-free permit is in force, have been added.

C2 – The requirements for encapsulation referenced in 6.6.2 and detailed in Annex D have been changed in terms of the thickness to the free surface and are extended related to moulding. Annex D is changed from informative to normative.

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Part 11: Equipment protection by intrinsic safety "i"

INTERPRETATION SHEET 2

This interpretation sheet has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
31G/252/ISH	31G/254/RVD

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

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Interpretation of 6.2.5 – Requirements for connections and accessories for IS apparatus when located in the non-hazardous area

Question:

Does the first NOTE of 6.2.5 imply that equipment which may be connected to non-intrinsically safe connection facilities of intrinsically safe apparatus restricted to use in non-hazardous area need to be assessed applying IEC 60079-11, if the value of U_m is less than 250 V a.c.? Does this furthermore apply to equipment to be connected to non-intrinsically safe connection facilities of associated apparatus, if the value of U_m is less than 250 V a.c.?

Background:

The first NOTE of 6.2.5 requires in cases were U_m is specified less than 250 V a.c. that this should not be derived from unassessed equipment. This is sometimes read as if the requirements of IEC 60079-11 should be applied for voltage limitation to guarantee U_m.

Terminological entry 3.13.13 defines that U_m is the maximum voltage that can be applied to the non intrinsically safe connection facilities of associated apparatus without invalidating the

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type of protection. NOTE 1 of 3.13.13, as an example, explains that this may apply to connection facilities used for charging batteries.

In IEC 60079-11 there are no measures required for limiting the voltage of non I.S. circuits to the specified U_m value, except for the use of a single Zener diode protected by a fuse as an integral measure of an associated apparatus limiting the voltage which can appear at a transformer (8.3) or a coupler (8.9.2).

IEC 60079-14: 2013, 16.2.1 states:

Where U_m marked on the associated apparatus is less than 250 V it shall be installed in accordance with one of the following:

a) where U_m does not exceed 50 V a.c. or 120 V d.c., in an SELV or PELV system, or

b) via a safety isolating transformer complying with the requirements of IEC 61558-2-6, or technically equivalent standard, or

c) directly connected to apparatus complying with the IEC 60950 series, IEC 61010-1, or a technically equivalent standard, or

d) fed directly from cells or batteries.

Answer

No

IEC 60079-11 does not require measures to limit U_m where it is specified as 250 V a.c. which is guaranteed by the public power supply using standards other than IEC 60079-11. Similarly, IEC 60079-14 allows measures not compliant with IEC 60079-11 for limiting U_m to below 250 V a.c.

Therefore no assessment of the voltage supply according to IEC 60079-11 is necessary where U_m is specified less than 250 V a.c. provided that one of the measures allowed by IEC 60079-14:2013, 16.2.1 are applied.

NOTE This does not alter the requirement of the 3rd paragraph of 6.2.5 to assess, in accordance with IEC 60079-11, any protective circuitry located in the non-hazardous area accessory.

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INTERPRETATION SHEET 3

This interpretation sheet has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
31G/253/ISH	31G/255/RVD

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

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Question

Regarding IEC 60079-11:2011 Edition 6.0 (2011-06), some clauses specifically indicate whether or not the requirement is applicable or not applicable to level of protection “ic”. However, many other clauses include no indication one way or the other, resulting in potential inconsistencies when applied. In the interest of improving consistency, what are the requirements in IEC 60079-11:2011 Edition 6.0 (2011-06) that are applicable to level of protection “ic”?

Answer

In answering this question, the following considerations were taken:

1) Requirements in IEC 60079-11 Edition 6.0 (2011-06) indicating that the requirements are applicable to level of protection “ic” are considered “Applicable”;
2) Requirements in IEC 60079-11 Edition 6.0 (2011-06) indicating that the requirements are not applicable to level of protection “ic” are considered “Not applicable”;
3) Regarding requirements in IEC 60079-11 Edition 6.0 (2011-06) other than those referenced in 1) and 2) above:
   - determine if the intent of these requirements for levels of protection "ia" and "ib" is to address fault (abnormal) conditions; and

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- if the intent is to address fault (abnormal) conditions, then the requirements are considered not applicable for level of protection "ic".

Based on the above considerations, the following informative table (similar in concept to Annex B of IEC 60079-0:2011 on Ex Components) provides guidance regarding which requirements in IEC 60079-11 Edition 6.0 (2011-06) are applicable to level of protection “ic”.

Additional background

As additional background details, the following seven key issues of principle were taken into account when developing the above answer:

1) Objective of the original transfer of type of protection “nL” to “ic”: The objective of the original transfer of type of protection “nL” to “ic” (as first included in IEC 60079-11 Fifth Edition) was not to substantially revise the applicable requirements, except where the maintenance team MT 60079-11 made specific reference to level of protection “ic” in a given clause. Examples of this include 7.1, which simplifies the rating requirements for level of protection “ic” protective components from “nL” requirements; and 6.2.1, which increases the separation distances for level of protection “ic” terminals (to align with IEC 60079-14) from “nL” requirements. This objective approach is consistent with how the transfer of other IEC 60079-15 types of protection have been handled, and are still being handled in other IEC 60079 series standards.
2) Common applications of a level of protection “ic” circuit that protects an arcing part: The following are common applications of a level of protection “ic” circuit that protects an arcing part:
   - The circuit does not exit the device.
   - The circuit exits one device and is interconnected via a wiring method to another device, with both devices and the interconnecting wiring method being part of a system.
   - The circuit exits a device via a receptacle, with entity parameters provided for field connection to the receptacle.
   - The circuit exits a device via a terminal block, with entity parameters provided for field connection to the terminal block.

   For all the above applications, the level of protection "ic" circuit does not begin until after the last protective component that establishes the necessary voltage and current limitation. For other circuitry in the device, another type of protection, such as “nA” or “ec”, is applied. It is also possible for an entire apparatus to be only ”Ex ic”.
3) Remarks in the draft I-SH: In the draft I-SH, the intent is for all Remarks to only be for issues specific to level of protection “ic”. The few exceptions to this are for Remarks highlighting requirements that, while applicable to all types of protection “i”, represent a significant change in requirements from type of protection “nL” to “ic”.
4) Transient effects on level of protection “ic” circuits: For level of protection “ic” circuits, the effects of transients are only addressed for diode safety barriers. This is because connection of such barriers is to unspecified equipment. For other level of protection “ic” circuit applications, no additional evaluation is required regarding the effects of transients based on the following considerations:
   - the presence of an explosive atmosphere is only under abnormal conditions; and
   - the circuit complies with the applicable safety requirements of the relevant industrial standards.
5) Separation distances for level of protection “ic” circuits: Separation distances are only applicable to the level of protection “ic” circuit and to the protective components that establish the level of protection “ic” circuit. Where separation distances are required, separations that do not comply with the values of Table 5 or Annex F are to be shorted as part of the evaluation, if the shorting may impair intrinsic safety.

6) Protective components for level of protection “ic” circuits: Voltage and current limiting protective components comply with the applicable requirements for components on which intrinsic safety depends (e.g. 7.1).

7) IEC/TC 31 MT 60079-15 support: The MT 60079-15 convener has been involved in the development of the content of this I-SH, and supports it based on the current IEC 60079-11 Edition 6.0 (2011-06) text.

The following informative table provides guidance regarding which requirements in IEC 60079-11 Edition 6.0 (2011-06) are applicable to level of protection “ic”.

Informative guide for level of protection “ic” evaluations

NOTE 1 In some cases, where a clause is indicated as “Applicable” to level of protection “ic”, it is applicable in its entirety. In other cases, the clause is only applicable in part. Remarks are provided to indicate which parts of a given clause are applicable to level of protection “ic”, along with indicating general explanatory content regarding the application of the clause to level of protection “ic”.

NOTE 2 Where a clause is indicated as being not applicable, in its entirety or in part, consideration is still given regarding the applicability of other IEC 60079-11 and IEC 60079-0 clauses, including the applicable safety requirements of the relevant industrial standards in accordance with IEC 60079-0.

Clause	Requirement	Applicability	Remark
1	Scope	Applicable	
2	Normative references	Applicable	
3	Terms and definitions	Applicable	For “ic” circuits, Ui, Ii, Pi are maximum values possible in normal operation. Uo, Io, Po are determined in normal operation, but with the most onerous rated load for each case attached. Reduction of maximum voltage from Um can be achieved with a transformer that complies with the applicable requirements of this standard. The same equipment designed for “ic”, and also designed for “ia” or “ib”, can have different parameters for connection to “ic” circuits versus connection to “ia” or “ib” circuits. Even though these are all the same “type of protection”, just with varying EPLs, the requirements under “Multiple types of protection” in IEC 60079-0 applies.
4	Grouping and classification of intrinsically safe apparatus and associated apparatus	Applicable	While “nL” was only a Gc type of protection, “ic” is for both Gc and Dc.
5	Levels of protection and ignition compliance requirements of electrical apparatus		
5.1	General	Applicable	Opening, shorting and earthing of an “ic” circuit at output terminals intended for field wiring are considered normal operating conditions.
5.2	Level of protection "ia"	Not applicable	Addresses safety factors and fault conditions for "ia".
5.3	Level of protection "ib"	Not applicable	Addresses safety factors and fault conditions for "ib".
5.4	Level of protection "ic"	Applicable	A safety factor of 1.0 with no fault condition is applicable for "ic".
5.5	Spark ignition compliance	Applicable	
5.6	Thermal ignition compliance		
5.6.1	General	Applicable	Temperature testing is to be under worst case normal operating conditions.
5.6.2	Temperature for small components for Group I and Group II	Applicable	
5.6.3	Wiring within intrinsically safe apparatus for Group I and Group II	Applicable	Requirement is addressed by testing according to 5.6.1, or addressed according to the applicable safety requirements of the relevant industrial standards.

Clause	Requirement	Applicability	Remark
5.6.4	Tracks on printed circuit boards for Group I and Group II	Applicable	Requirement is addressed by testing according to 5.6.1, or addressed according to the applicable safety requirements of the relevant industrial standards.
5.6.5	Intrinsically safe apparatus and component temperature for Group III	Applicable	Temperature classification to be based on the temperature of the surface exposed to dust.
5.7	Simple apparatus	Applicable	
6	Apparatus construction		
6.1	Enclosures	Applicable	
6.2	Facilities for connection of external circuits		
6.2.1	Terminals	Applicable	NOTE As with “ia” and “ib”, due to IEC 60079-14 installation requirements, circuits that exit a piece of equipment via a terminal block, with entity parameters provided for field connection to the terminal block, maintain the following: – at least 50 mm separation distance between terminals for “ic” circuits and terminals for non-intrinsically safe circuits. – at least 6 mm separation distance between terminals for separate intrinsically safe circuits. – at least 3 mm separation distance between terminals for intrinsically safe circuits and earthed parts, if connection to earth has not been considered in the safety analysis. This separation distance requirement is different from previous Ex “nL” requirements.
6.2.2	Plugs and sockets	Applicable	
6.2.3	Determination of maximum external inductance to resistance ratio (L_o/R_o) for resistance limited power source	Applicable	
6.2.4	Permanently connected cable	Applicable	
6.2.5	Requirements for connections and accessories for IS apparatus when located in the non-hazardous area	Applicable	Applicable except regarding protective circuitry for functions such as charging in the non-hazardous area. As there is no application of faults, the ratings of components may be ensured without additional protection.
6.3	Separation distances		
6.3.1	General	Applicable	Applicable to “ic” circuit and protective components only. Where separation distances are less than required, they are to be shorted if the shorting may impair intrinsic safety. NOTE For example, an "ic" circuit is the circuit after the last protective component that establishes the necessary voltage and current limitation.

Clause	Requirement	Applicability	Remark
6.3.2	Separation of conductive parts	Applicable	Applicable to "ic" circuit and protective components only. Any use of an interposing insulating partition or earthed metallic partition is only required to comply with the safety requirements of the relevant industrial standard.
6.3.2.1	Distances according to Table 5	Applicable	Regarding transformers, only applicable between external connections. Remaining construction features of transformers are only required to comply with the applicable safety requirements of the relevant industrial standards.
6.3.2.2	Distances according to Annex F	Applicable	Regarding transformers, only applicable between external connections. NOTE Remaining construction features of transformers are only required to comply with the applicable safety requirements of the relevant industrial standard. Through solid insulation of conductors are required to comply with Table 5.
6.3.3	Voltage between conductive parts	Applicable	For “ic”, the effects of transients are only addressed for diode safety barriers because connection is to unspecified equipment. For other “ic” applications, no additional evaluation is required regarding the effects of transients based on the following considerations: • The presence of an explosive atmosphere is not likely to occur in normal operation. • The circuit complies with the applicable safety requirements of the relevant industrial standards. Where separation of conductive parts is required, separations that do not comply with the values of Table 5 or Annex F may be shorted as part of the evaluation if it may impair intrinsic safety.
6.3.4	Clearance	Not Applicable	Any use of an interposing insulating partition or earthed metallic partition is only required to comply with the safety requirements of the relevant industrial standard. See 6.3.2.
6.3.5	Separation distances through casting compound	Applicable	
6.3.6	Separation distances through solid insulation	Applicable	
6.3.7	Composite separations	Applicable	Applicable, except regarding the 1/3 restriction for composite separations, as this restriction is based on fault considerations.
6.3.8	Creepage distance	Applicable	Applicable, except regarding the 1/3 restriction for composite separations, and the partition restrictions above 1,575 V. Any use of an interposing insulating partition or earthed metallic partition shall comply with the safety requirements of the relevant industrial standard. See 6.3.2.
6.3.9	Distance under coating	Applicable	

Clause	Requirement	Applicability	Remark
6.3.10	Requirements for assembled printed circuit boards	Applicable	Applicable, except for consideration of the body of a component as being an uninsulated live part. For example, a component mounted over or adjacent to tracks as defined in c) is not considered as connected to the track.
6.3.11	Separation by earthed screens	Applicable	Where separation distances to the earthed screen do not comply with the required separation distances to earth, the screen is to be capable of carrying the maximum possible current to which it could be continuously subjected (such as a short to earth).
6.3.12	Internal wiring	Applicable	
6.3.13	Dielectric strength requirement	Applicable	Applicable, except for the additional dielectric strength testing in the 3rd paragraph. Regarding the 2nd paragraph, only applicable to insulation or insulating components. Additional dielectric testing is not required between level of protection "ic" and other circuits, or between separate level of protection "ic" circuits. This aligns with previous level of protection "nL" requirements. NOTE Dielectric test requirements of other applicable standards may still apply (such as the relevant industrial standards).
6.3.14	Relays	Applicable	Applicable only regarding requirement for relay to be used within its rating. NOTE Requirements for dielectric and separation distances are still addressed, along with applicable safety requirements of the relevant industrial standards.
6.4	Protection against polarity reversal	Applicable	
6.5	Earth conductors, connections and terminals	Applicable	Earthing requirements in the 1st paragraph are only applicable if earth is necessary for "ic" circuit. Requirements for earthing are suitably addressed by the applicable safety requirements of the relevant industrial standards. Requirements in 2nd paragraph only applicable to level of protection "ia" and level of protection "ib". A single connection is sufficient for level of protection ‘ic’.
6.6	Encapsulation	Applicable	Applicable only if relying on encapsulation to exclude the atmosphere so as to reduce separation distances, or reduce the ignition capability of hot components. No short conditions are applied unless separation distances are less than required values so as to impair intrinsic safety (see Annex D).
7	Components on which intrinsic safety depends		
7.1	Rating of components	Applicable	For voltage and current, this clause simplifies the rating requirements for “ic” protective components from “nL” requirements. NOTE The concept of a component having a defined "failure mode such that protection is maintained" as an alternative to de-rating (as existed for "nL") does not exist for "ic".

Clause	Requirement	Applicability	Remark
7.2	Connectors for internal connections, plug-in cards and components	Applicable	Applicable except for requirement regarding incorrect connection of internal plug-in connections in the 1st paragraph, and the open circuit failure of a connection requirement in the 2nd paragraph. While interchangeability is a concern for external connections due to field error, it is not considered an “ic” concern for internal connections. Production control and proper service expectations can address internal applications. Open circuit failure of a connection requirement is not applicable because faults are not considered for ‘ic’. Both are not considered a normal operations condition (see 6.5).
7.3	Fuses	Applicable	Where an “ic” circuit depends upon a fuse **and** where the fuse is directly connected to the mains **and** where the fuse is also directly connected to a circuit that is considered normally subject to overloading or shorting (such as output field wiring receptacles or terminals), the breaking capacity of such a fuse is based upon the prospective short circuit current of the mains supply. A diode safety barrier would be a common example of such an application involving output field wring terminals. The prospective short-circuit current of a 250 V mains supply is considered to not be greater than 1 500 A.”
7.4	Primary and secondary cells and batteries	Applicable	For both apparatus and associated apparatus, when such involves more than type of protection “ic” (such as ‘ic nA’ apparatus or ‘nA [ic]’ associated apparatus), connection of cells and batteries in parallel for ‘ic’ is only permitted in the ‘ic’ circuit provided that intrinsic safety is not impaired.
7.5	Semiconductors		
7.5.1	Transient effects	Applicable	For “ic”, the effects of transients are only addressed for diode safety barriers because connection is to unspecified equipment. For other “ic” applications, no additional evaluation is required regarding the effects of transients based on the following considerations: • The presence of an explosive atmosphere not likely to occur in normal operation. • The circuit complies with the applicable safety requirements of the relevant industrial standards. NOTE Semiconductors serving as protective components in "ic" circuits are required to comply with the applicable requirements elsewhere in this standard.

Clause	Requirement	Applicability	Remark
7.5.2	Shunt voltage limiters	Applicable	For “ic”, the effects of transients are only addressed for diode safety barriers because connection is to unspecified equipment. For other “ic” applications, no additional evaluation is required regarding the effects of transients based on the following considerations: • The presence of an explosive atmosphere is not likely to occur in normal operation. • The circuit complies with the applicable safety requirements of the relevant industrial standards. For level of protection ‘ic’, a single semiconductor is sufficient.
7.5.3	Series current limiters	Applicable	For level of protection “ic” a single semiconductor is sufficient.
7.6	Failure of components, connections and separations	Applicable	Applicable except for "ia" and "ib" requirements in 2nd paragraph, and infallible connections requirements in 5th and 6th paragraphs.
7.7	Piezo-electric devices	Applicable	Applicable only if the piezo-circuit can be directly shorted (for example due to non-compliant spacings or sparking components) (see 10.7). NOTE The potential for the enclosure to be impacted is a normal operating condition, and therefore is applicable to "ic".
7.8	Electrochemical cells for the detection of gases	Applicable	
8	Infallible components, infallible assemblies of components and infallible connections on which intrinsic safety depends	Not applicable	According to 8.1, Clause 8, in its entirety, does not apply for "ic" circuits.
9	Supplementary requirements for specific apparatus		
9.1	Diode safety barriers	Applicable	For “ic”, the effects of transients are addressed for diode safety barriers because connection is to unspecified equipment. NOTE Earthing requirements are applicable to “ic” due to the earthing requirements of intrinsically safe circuits in IEC 60079-14.
9.2	FISCO apparatus	Applicable	
9.3	Handlights and caplights	Applicable	
10	Type verifications and type tests		
10.1	Spark ignition test	Applicable	A safety factor of 1.0 with no countable or non-countable fault conditions is applicable for "ic".
10.2	Temperature tests	Applicable	Applicable except for non-linear concerns in the last line of the 1st paragraph, which would require mandatory testing of components with non-linear aspects in the actual rated ambient. Such an approach to testing is not applicable for "ic" circuits, and is only to be an option.
10.3	Dielectric strength tests	Applicable	See 6.3.13.

Clause	Requirement	Applicability	Remark
10.4	Determination of parameters of loosely specified components	Applicable	
10.5	Tests for cells and batteries	Applicable	Applicable except short circuit testing is only to be considered at points external to the cell or battery where the required separation distances are not met. Where temperature rise testing of the cells and batteries is required, only one sample need be subjected to the testing.
10.6	Mechanical tests		
10.6.1	Casting compound	Applicable	Force and impact testing is applicable to casting compounds that complete enclosures. As such, this is a normal operating conditions concern, and the testing is therefore applicable to "ic".
10.6.2	Determination of the acceptability of fuses requiring encapsulation	Applicable	While encapsulation of fuses for “ic” is not generally required, the concern regarding encapsulation flowing within the chamber of a fuse, and preventing the element to open, does reflect a normal operating conditions concern, and therefore is applicable to "ic" circuits (also see 7.3). NOTE One example of such a concern is for glass cartridge fuses.
10.6.3	Partitions	Not applicable	Any use of an interposing insulating partition or earthed metallic partition is only required to comply with the safety requirements of the relevant industrial standard.
10.7	Tests for intrinsically safe apparatus containing piezoelectric devices	Applicable	Applicable only if the piezo-circuit can be directly shorted (for example due to non-compliant spacings or sparking components)(see 7.7). NOTE The potential for the enclosure to be impacted is a normal operating condition, and therefore is applicable to "ic".
10.8	Type tests for diode safety barriers and safety shunts	Applicable	For level of protection “ic”, the effects of transients are to be addressed for diode safety barriers because connection is to unspecified equipment. (See 7.5.1)
10.9	Cable pull test	Applicable	
10.10	Transformer tests	Not applicable	This testing is required by 8.2.4, which is explicitly waived for "ic" circuits. NOTE Applicable safety requirements of the relevant industrial standards still apply.
10.11	Optical isolators tests	Not applicable	This testing is required by 8.9.2, which is explicitly waived for "ic" circuits. NOTE Applicable safety requirements of the relevant industrial standards still apply.
10.12	Current carrying capacity of infallible printed circuit board connections	Not applicable	This testing is required by 8.8, which is explicitly waived for "ic" circuits.
11	Routine verifications and tests		
11.1	Routine tests for diode safety barriers		
11.1.1	Completed barriers	Applicable	NOTE Removable links are not generally needed for level of protection “ic” safety barriers.

Clause	Requirement	Applicability	Remark
11.1.2	Diodes for 2-diode "ia" barriers	Not applicable	This testing is applicable only to "ia" circuits.
11.2	Routine tests for infallible transformers	Not applicable	This testing is required by 8.2.5, which is explicitly waived for "ic" circuits.
12	Marking	Applicable	Where it is necessary to include marking from one of the other methods of protection listed in IEC 60079-0, the symbol “ic” shall occur first.
13	Documentation	Applicable	Where “ic” live maintenance procedures are specified by the manufacturer in the instructions provided, the effects of this live maintenance do not invalidate intrinsic safety under both normal operating conditions and under conditions that may reasonably be considered to occur during live maintenance.
Annex A (normative)	Assessment of intrinsically safe circuits	Applicable	
Annex B (normative)	Spark test apparatus for intrinsically safe circuits	Applicable	
Annex C (informative)	Measurement of creepage distances, clearances and separation distances through casting compound and through solid insulation		
Annex D (normative)	Encapsulation	Applicable	Applicable only if relying on encapsulation to exclude the atmosphere so as to reduce separation distances, or reduce the ignition capability of hot components. No fault conditions are applied unless separation distances are less than required values (see 6.6.2).
Annex E (informative)	Transient energy test		
Annex F (normative)	Alternative separation distances for assembled printed circuit boards and separation of components	Applicable	Regarding transformers, only applicable between external connections. NOTE Remaining construction features of transformers are required to only comply with the applicable safety requirements of the relevant industrial standard. Through solid insulation of conductors are required to comply with Table 5.
Annex G (normative)	Fieldbus intrinsically safe concept (FISCO) - Apparatus requirements	Applicable	
Annex H (informative)	Ignition testing of semiconductor limiting power supply circuits		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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IEC 60079-11
Edition 6.0 2011-06

EXPLOSIVE ATMOSPHERES –

Part 11: Equipment protection by intrinsic safety "i"

INTERPRETATION SHEET 4

This interpretation sheet has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
31G/293/DISH	31G/296/RVD

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

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The wording in the intrinsic safety standard, IEC 60079-11 (2011), with respect to the enclosure requirements for intrinsically safe apparatus for Group III where the separation is accomplished by meeting the requirements for clearance or creepage distances of Table 5 or Annex F, according to Subclause 6.1.3a), is ambiguous. This observation may lead to different interpretation by different test laboratories.

This issue was discussed at the Busan, Republic of Korea meeting of the MT in October 2018. The MT agreed at that meeting that this interpretation should also be applied to IEC 60079-11:2011.

Because the title of Subclause 6.1.2.3 is “Apparatus complying with Annex F”, an interpretation has been made that the additional tests required by 6.1.2.3a) only apply when Annex F is used. The potential for compromising infallible creepage and clearance distances exists when Annex F is applied, but also exist when Table 5 is applied.

The wording of IEC 60079-11 is:

6.1.3 Enclosures for Group III apparatus

Where the intrinsic safety of intrinsically safe apparatus can be impaired by ingress of dust or by access to conducting parts, for example if the circuits contain infallible creepage distances, an enclosure is necessary by one of the following:

a) Where separation is accomplished by meeting the requirements for clearance or creepage distances of Table 5 or Annex F, the enclosure shall provide a degree of protection of at least IP5X, according to IEC 60529. For such enclosures the [*requirements of*] 6.1.2.3 a) shall additionally apply.

The text of the referenced clause is:

6.1.2.3 Apparatus complying with Annex F

Apparatus meeting the separation requirements of Tables F.1 or F.2 shall be provided with protection to achieve pollution degree 2. This can be achieved by one of the following:

a) an enclosure meeting the requirements of IP54 or greater according to the intended use and environmental conditions in accordance with IEC 60529. For such enclosures the clauses of IEC 60079-0 identified in Table 1 additionally apply.

Question

For Groups IIIA, IIIB, and IIIC, where Annex F is not applied and the creepage or clearance distances of Table 5, Column 2 or Column 5 are relied upon for intrinsic safety, do all the applicable enclosure requirements of IEC 60079-0 listed in Table 1, including thermal endurance and resistance to impact, apply?

Interpretation

Yes, for Groups IIIA, IIIB, IIIC, the “Tests of enclosures” requirements of IEC 60079-0 apply for intrinsically safe apparatus for which the creepage and clearance distances are assessed against either Table 5 or Annex F.

This does not apply where the separations are protected by means other than an enclosure, such as encapsulation or conformal coating as described in 6.1.3b) of IEC 60079-11.

NOTE These tests are specified in the following subclauses of IEC 60079-0:2011; 6.2, 6.5, 7.1.1, 7.1.2.1, 7.1.2.2, 7.1.2.3, 7.2, 7.3, 12, 16, 26.4.1, 26.4.1.1, 26.4.1.2, 26.4.1.2.1, 26.4.1.2.2, 26.4.2, 26.4.3, 26.4.4, 26.5.2, 26.7, 26.8, 26.9, 26.10, 26.16, as well as Annex C and Annex F.

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IEC 60079-11
Edition 6.0 2011-06

EXPLOSIVE ATMOSPHERES –

Part 11: Equipment protection by intrinsic safety "i"

INTERPRETATION SHEET 5

This interpretation sheet has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
31G/306/DISH	31G/308/RVDISH

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

BACKGROUND

As stated in the scope of Edition 6 of IEC 60079-11 (2011), the standard supplements and modifies the general requirements of IEC 60079-0. Subsequent to the publication of Edition 6 of IEC 60079-11, IEC 60079-0 was revised. The revised version of IEC 60079-0 (Edition 7:2017) now contains the 200 mm dust blanketing temperature test for Group III Da equipment (Subclause 5.3.2.3.1), relocated from IEC 60079-18 and IEC 60079-31.

QUESTIONS

1) Does the alternative approach of IEC 60079-11:2011 for equipment with components dissipating less power than given in Table 4 and with continuous short-circuit current less than 250 mA still apply when assessing according to IEC 60079-0:2017?
2) Is it necessary to conduct the 200 mm dust blanket temperature testing of Group III EPL Da intrinsically safe apparatus when applying IEC 60079-0:2017 in situations where the power limits of IEC 60079-11:2011 Table 4 are exceeded?

IEC 60079-11:2011-06/ISH5:2019-08(en)

ICS 29.260.20

ANSWER

1) Yes. The requirement of IEC 60079-0 is modified by the requirement of IEC 60079-11 and the requirements of IEC 60079-11 take precedence over IEC 60079-0.
2) Yes.

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IEC 60079-11
Edition 6.0 2011-06

EXPLOSIVE ATMOSPHERES –

Part 11: Equipment protection by intrinsic safety "i"

INTERPRETATION SHEET 6

This interpretation sheet has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
31G/311/DISH	31G/314/RVDISH

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

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Background

The second and third paragraphs of IEC 60079-11:2011, Subclause 10.5.3 b) state the following:

The maximum surface temperature shall be determined as follows:

For "ia" and "ib" all current-limiting devices external to the cell or battery shall be short-circuited for the test. The test shall be carried out both with internal current-limiting devices in circuit and with the devices short-circuited using 10 cells in each case. The 10 samples having the internal current-limiting devices short-circuited shall be obtained from the cell/battery manufacturer together with any special instructions or precautions necessary for safe use and testing of the samples. If the internal current limiting devices protect against internal shorts then these devices need not be removed. However, such devices shall only be considered for Level of Protection "ib".

The intent of the cited paragraphs is to simulate an internal short inside a cell, by shorting the cell's external terminals for the purpose of thermal assessment.

It was found that two details have been misinterpreted in these paragraphs:

a) The subjects of the paragraphs are cells or batteries, while the intent is clearly to simulate internal shorts inside cells and not inside batteries in which case the shorts could be interpreted as being external to the cell(s) within a battery.

b) It is unclear what constitutes a current limiting device that protects against internal shorts.

A separator with shutdown function may be interpreted as a current limiting device that protects against internal shorts by its function, but since it is a constructional part of the cell that is not removable without invalidating the functionality of the basic cell, it is not a current limiting device for the purposes of implementing the standard. Conversely, a CID (Current interruption device), for example, is a switch that is triggered by increased pressure inside the cell, and the cell's functionality is not invalidated by the absence of the CID.

The reference to internal current limiting devices that protect against internal shorts in edition 6 was included to address unknown future cell technologies which could include such current limiting devices, however at this time no such current limiting devices are known.

Question

For either Level of Protection "ia" or "ib", what are the current limiting devices that are required to be disabled (or equivalent e.g. not fitted, short-circuited or removed) by IEC 60079-11:2011, Subclause 10.5.3 b), and what are the current limiting devices that need not be disabled?

Answer

All discrete protective devices that can be schematically represented as individual devices apart from the cell are to be disabled for the purposes of testing according to IEC 60079-11:2011, Subclause 10.5.3 b), regardless if they are located inside the cell or if they are external to the cell. This includes, but is not limited to resistors, fuses, resettable fuses (NTC, PTC, PPTC), CID (current interruption device), semiconductors, etc.

Features that provide essential cell functions, such as a separator with shutdown function or the ohmic resistance of the electrolyte, are not considered current limiting devices in the sense of this clause and need not be shorted or removed, and such cells can be considered for Level of Protection "ia".

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FOREWORD

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International Standard IEC 60079-11 has been prepared by subcommittee 31G: Intrinsically safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

This sixth edition cancels and replaces the fifth edition of IEC 60079-11 published in 2006, the first edition of IEC 61241-11 published in 2005, and the new Annex G replaces the apparatus requirements of the second edition of IEC 60079-27 published in 2008. This sixth edition constitutes a technical revision of these publications.

NOTE IEC 60079-25 cancels and replaces the remaining subject matter of IEC 60079-27.

The significant changes with respect to the previous edition are listed below:

- Inclusion of non-edition specific references to IEC 60079-0.
- The merging of the apparatus requirements for FISCO from IEC 60079-27.
- The merging of the requirements for combustible dust atmospheres from IEC 61241-11.

- Clarification of the requirements for accessories connected to intrinsically safe apparatus; such as chargers and data loggers.
- Addition of new test requirements for opto-isolators.
- Introduction of Annex H about ignition testing of semiconductor limiting power supply circuits.

The text of this standard is based on the following documents:

FDIS	Report on voting
31G/207/FDIS	31G/213/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This standard supplements and modifies the general requirements of IEC 60079-0, except as indicated in Table 1 (see Scope).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60079 series, under the general title: *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of January 2012, the interpretation sheet 1 of October 2014, the interpretation sheet 2 and 3 of July 2016, the interpretation sheet 4 of April, the interpretation sheet 5 of August 2019 and interpretation sheet 6 of December 2019 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.